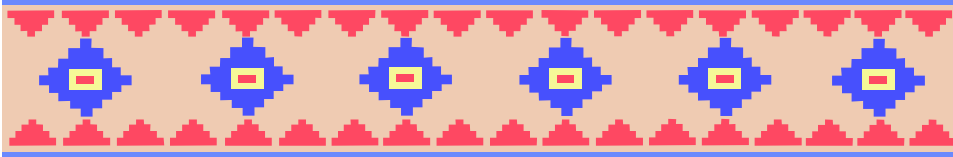


# Algebra/Geometry Institute Summer 2009



**Faculty Name: Kimberly Taylor**

**School: Tunica Middle**

**Grade Level: 9<sup>th</sup> – 12<sup>th</sup>**

## 1 Teaching objective(s)

- The students will recognize, explore, model, and continue a pattern utilizing color tiles.
- The students will understand, represent, and analyze patterns, relations, and functions.

## 2 Instructional Activities

- The teacher will introduce the lesson by making the following statements:
  - Tell students that patterns are all around them.
  - Ask students where do they see patterns?
  - Suggest poems(rhymes, aabb, bbaa), quilts, floor tiles, music(rhymes, meters, refrains), word families(cat, bat, hat).
  - The teacher will discuss with students why these patterns exist and ask them what they think a pattern is. Discuss the meaning of a pattern.
  - The teacher will ask students why they think patterns are essential to learning algebra.
  - The teacher will suggest to students that finding and extending patterns are valuable steps towards making predictions and making generalizations. Patterns help you to develop algebraic thinking by showing you a visual of the connection between algebra and problem solving.
  - Tell students that before they leave class today, they will be able to recognize a pattern, continue that pattern, and organize their findings in a chart.
  - Also, tell students that they will utilize this data to plug in necessary information in order to figure out algebraic equations via different formulas.

- The teacher will place a pattern on the overhead and give students the following directions:
  - Tell students that each table has a bucket of color tiles and that they will only be using blue, red, and green. Tell them to each form the pattern that they see on the overhead.
  - Then tell students to add a row of squares all around the rectangle. Make the corner squares blue, the side squares red, and the top and bottom squares, green.
  - Tell students that this process, building one stage from the previous one is called *recursive*.
  - Tell the students to observe their design and comment on their patterns.
  - Tell students to count the number of blue, red, and green tiles in Stages 1, 2, and 3, and record the information on their charts.
  - Ask students which color is growing at the slowest rate? At the fastest rate?
  - The teacher will ask students what they could do to come up with the growth rates without using a plethora of tiles.
  - Tell students to use the data they collected from their chart to come up with a formula to get the growth rate of each colored tile plus the total growth rate.
  - The teacher will circulate the room to ensure that students are coming up with the correct formulas.
  - Give students a hint like since they know that the blue squares grew constantly by 4, figure out where would the 4 fit into a formula and so on.
  - Tell students to work individually to get the growth rate of all 3 colored tiles for stages 4 and 5.
  - Now ask students what they noticed about the blue, red, and green growth rates?
  - The teacher will walk around to each student to observe whether they are plugging in their chart data to work the equations.
  - Have students to volunteer to put their formulas on the overhead and explain them. Students must have the following formulas (blue is  $4n+2$ , red is  $2n^2$ , green is  $2n^2+2n$ , total number of squares  $4n^2+6n+2$ ).
  - Clear up any discrepancies.
  - Now tell students that they will work individually to take an assessment on the skills they learned today.

### 3 Materials

- Overhead Projector
- Transparencies with 1-inch squares
- Color Tiles
- Pattern Chart

#### Resources

- Van de Walle, John A. (2004). Elementary and Middle School Mathematics: Teaching Developmentally. -5<sup>th</sup> ed. (pp.418-422).
- <http://math.rice.edu/~lanius/Lessons/Patterns/recans2.html> , Rectangular Patterns (adapted lesson). Retrieved from the World Wide Web on June 7, 2009.

### 4 Assessment

- Teacher-created activity sheet (Attachment 4).
- The students will complete activity sheet 4 individually. They will be given color pencils/markers to color in their patterns on the grid paper.
- The teacher will walk around and monitor the students as they work.
- The activity sheet will be graded, and given back to students for discussion and correction.

## Activity Sheet

Name \_\_\_\_\_ Date \_\_\_\_\_

**Directions:** Read the following prompts and do exactly what they say.

- Add a row of squares all around the rectangle.
- Make the corner squares blue, the side squares red, and the top and bottom squares green. This process is called *recursive* because you are building one stage from the previous one.
- Count and record the number of blue tiles in Stages Number 1 -3.
- Count and record the number of red tiles in Stages Number 1-3.
- Count and record the number of green tiles in Stage Number 1-3

<b>Stage No.</b>	1	2	3	4	5	<b>n</b>
<b>No. Blue Squares</b>						
<b>No. Red Squares</b>						
<b>No. Green Squares</b>						
<b>Total No. Squares</b>						

## Questions to Ponder?

1. Which color is growing at the slowest rate?
2. Which color is growing at the fastest rate?
3. How can you determine how many squares of each color will be in the 4<sup>th</sup> and 5<sup>th</sup> stage without tediously using a plethora amount of color tiles?
4. Write your formula for the growth rate of the blue squares, and show all of your work.
5. Write your formula for the growth rate of the red squares, and show all of your work.
6. Write your formula for the growth rate of the green squares, and show all of your work.
7. Write your formula for total number of squares, and show all of your work.

## Activity Sheet Answers

Name \_\_\_\_\_ Date \_\_\_\_\_

**Directions:** Read the following prompts and do exactly what they say.

- Add a row of squares all around the rectangle.
- Make the corner squares blue, the side squares red, and the top and bottom squares green. This process is called *recursive* because you are building one stage from the previous one.
- Count and record the number of blue tiles in Stages Number 1 -3.
- Count and record the number of red tiles in Stages Number 1-3.
- Count and record the number of green tiles in Stage Number 1-3

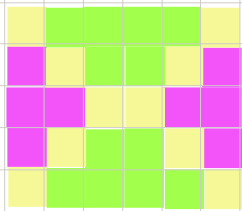
<b>Stage No.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>n</b>
<b>No. Blue Squares</b>	6	10	14	18	22	<b><math>4n+2</math></b>
<b>No. Red Squares</b>	2	8	18	32	50	<b><math>2n^2</math></b>
<b>No. Green Squares</b>	4	12	24	40	60	<b><math>2n^2 + 2n</math></b>
<b>Total No. Squares</b>	12	30	56	90	132	<b><math>4n^2 + 6n + 2</math></b>

### Questions to Ponder Answers for Activity Sheet

1. blue
2. green
3. Utilize the data from your chart to figure out a formula.
4.  $4n+2$
5.  $2n^2$
6.  $2n^2+2n$
7.  $4n^2+6n+2$

**Attachment # 3**

Utilize this graph paper to continue the pattern and answer the previous questions.





### Pattern Assessment

Name \_\_\_\_\_ Date \_\_\_\_\_

**Directions:** Read the following prompts and do exactly what they say.

- Add a row of squares all around the rectangle.
- Make the corner squares yellow, the side squares pink, and the top and bottom squares green. This process is called *recursive* because you are building one stage from the previous one.
- Count and record the number of yellow tiles in Stages Number 1-3.
- Count and record the number of pink tiles in Stages Number 1-3.
- Count and record the number of green tiles in Stages Number 1-3.

<b>Stage No.</b>	1	2	3	4	5	<b>n</b>
<b>No. Yellow Squares</b>						<b><math>4n+6</math></b>
<b>No. Pink Squares</b>						
<b>No. Green Squares</b>						
<b>Total No. Squares</b>						

## Questions to Ponder?

1. Which color is growing at the slowest rate?
2. Which color is growing at the fastest rate?
3. How can you determine how many squares of each color will be in the 4<sup>th</sup> and 5<sup>th</sup> stage without tediously using a plethora amount of color tiles?
4. Write your formula for the growth rate of the yellow squares, and show all of your work.
5. Write your formula for the growth rate of the pink squares, and show all of your work.
6. Write your formula for the growth rate of the green squares, and show all of your work.
7. Write your formula for total number of squares, and show all of your work.

### Pattern Assessment Answers

Name \_\_\_\_\_ Date \_\_\_\_\_

**Directions:** Read the following prompts and do exactly what they say.

- Add a row of squares all around the rectangle.
- Make the corner squares yellow, the side squares pink, and the top and bottom squares green. This process is called *recursive* because you are building one stage from the previous one.
- Count and record the number of yellow tiles in Stages Number 1-3.
- Count and record the number of pink tiles in Stages Number 1-3.
- Count and record the number of green tiles in Stages Number 1-3.

<b>Stage No.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>n</b>
<b>No. Yellow Squares</b>	10	14	18	22	26	$4n+6$
<b>No. Pink Squares</b>	8	18	32	50	72	$2(n+1)^2$ or $2n^2 + 4n + 2$
<b>No. Green Squares</b>	12	24	40	60	84	$2(n+1)^2 + 2(n+1)$ or $2n^2 + 6n + 4$
<b>Total No. Squares</b>	30	56	80	132	182	$4n^2 + 14n + 12$

### Questions to Ponder Answers for Activity Sheet

1. yellow
2. green
3. Utilize the data from your chart to figure out a formula.
4.  $4n+6$
5.  $2(n+1)^2$  or  $2n^2+4n+2$
6.  $2(n+1)^2+2(n+1)$  or  $2n^2+6n+4$
7.  $4n^2+14n+12$